POTENTIAL OF ENERGY IMPROVEMENT AT A MALAYSIAN SMALL INDUSTRY

CASE STUDY: PERUSAHAAN SERI MAS

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To my beloved father and mother, Mashori bin Haji Abdul Hadi and Suriah binti Kasbadri, who has given me their support morally and physically to pursue my goals in education, I wish them the success and happiness in their lives, may ALLAH bless them. To my supervisor Dr Nor Asiah binti Muhamad, I would like to wish her my sincere love for the support and encouragement. To my family members and all my friends, I would like to wish them all the best in their lives

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ABSTRACT

Small and Medium size Enterprise (SMEs) are considered as a backbone of industrial development which plays a vital role in the Malaysian economy. An enterprise is considered as an SME based on the annual sales turnover or number of full time employees. Most of the researchers only focused on the company which generates higher profit annually and a few studies covered on the small industry. Particularly when dealing with very small organization, some of us might think that the organization only use small amount of energy, assuming there is nothing to reduce and did not had much potential to save. This study analyzes the potential of energy improvement at small industry focusing on Perusahaan Seri Mas. Site visit, monitoring and measuring were used to collect energy data, hence the cost calculation, energy saving and payback time will be evaluate. The replacement of T8 36W fluorescent lamp magnetic ballast and installing vertical blind will improve the lighting system, while installing Dodol Instruction Box could improve the cooking quality standard and avoid time lag with the payback time less than four years. As a conclusion, the projection done to small industries at Batu Pahat with annual energy saving is 11.646MWh and some recommendation for future works also present.

ABSTRAK

Industri kecil dan sederhana (IKS) merupakan tulang belakang pembangunan ekonomi di Malaysia. Pengkelasan IKS adalah berdasarkan hasil pulangan tahunan atau bilangan pekerja sepenuh masa. Dewasa kini, kebanyakkan penyelidik lebih gemar fokus kepada industri yang menjana pendapatan tahunan yang tinggi dan hanya sedikit yang mengambilkira industri kecil. Ramai beranggapan organisasi kecil hanya menggunakan sedikit tenaga serta kurangnya potensi penjimatan tenaga yang boleh dilakukan. Kajian kes dilakukan di Perusahaan Seri Mas meliputi analisa potensi penambahbaikan tenaga di industri kecil. Kerja-kerja lapangan, pemerhatian dan pengukuran audit tenaga dilakukan dan pengiraan kos, penjimatan tenaga serta tempoh pulangan dinilai. Penukaran lampu kalimantang T8 36W dan penggunaan bidai mampu meningkatkan sistem pencahayaan, manakala penggunaan Kotak Arahan Memasak Dodol mampu mencapai standard kualiti memasak dodol yang ditetapkan dengan tempoh pulangan kurang daripada empat tahun. Ramalan penjimatan tenaga tahunan bagi industri kecil sekitar Batu Pahat membuktikan sebanyak 11.646MWh tenaga boleh dijimatkan dan cadangan penambahbaikan untuk kajian akan datang turut dibincangkan.

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LIST OF ABBREVIATIONS

SME	-	Small and Medium size Enterprise
GDP	-	Gross Domestic Product
CACR	-	Compound Annual Growth Rate
kWh	-	kilo Watt hour
MWh	-	Mega Watt hour
GWh	-	Giga Watt hour
RM	-	Ringgit Malaysia
EE	-	Energy Efficiency
ITA	-	Investment Tax Allowance
EMEER		Effficient Managemant of Electrical Energy Regulation
ST	-	Suruhanjaya Tenaga
SAVE	-	Sustainability Achieved via Energy Efficiency
TNB	-	Tenaga Nasional Berhad
RI		Room Index
IES	-	Illuminating Engineering Society
JKR	-	Jabatan Kerja Raya
HVAC	-	System Heating Ventilating and Air Conditioning

LPG	-	Liquefied Petroleum Gas
LCD		Liquid Crystal Display
LED	-	Light Emitting Diode

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CHAPTER 1

INTRODUCTION

1.1 Project Background

The European Commission define the micro, small and medium sized enterprises (SMEs) if the full time workers are less than 250 persons, with an annual turnover not exceeding 50 million euro, and/or annual balance sheet ceiling less than 43 million euro. In Malaysia, the SMEs are considered as a backbone of industrial development which plays a vital role in the Malaysian economy. An enterprise is considered as an SME based on the annual sales turnover or number of full time employees.

However, there are several definitions of Malaysian SMEs; based on the type of sector the enterprise is operating. Effectively on January 1, 2014 SMEs in Malaysia are defined into two categories as follows [1]:

i) Manufacturing sector: Sales turnover less than RM50 Million OR full-time employees less than 200 employees.

ii) Services and other sectors: Sales turnover less than RM20 Million OR full-time employees less than 75 employees.

The SMEs in both sectors (manufacturing, services and others sectors) are categorized into micro, small and medium enterprises, based on annual sales turnover and number of full time employees as shown in Table 1.1. The manufacturing, service and other sectors were define as micro industry either by the sales turnover less than RM300,000 or full time employees less than 5. The small industry under manufacturing sector was define as either the annual sales turnover between RM300,000 and RM15 million or the number of full time employees between 5 and 75, while under service and other sector is classified based on the sales turnover between RM300,000 and RM3 milion or between 5 and 30 full time employees. However, if the sales turnover between RM15 million and RM50 million or full time employees between 75 and 200, it was classified under medium manufacturing industry.

Based on this definition, a research was conduct to investigate the potential of energy improvement at a Malaysian small industry. The study was done at Perusahaan Seri Mas, located at Ayer Hitam Johor which produced dodol and coconut candy. Since the number of full time employees are only six workers, therefore the small manufacturing sector is determine as the main scope of this project.

Table 1.1: Definition of SMEs Malaysia based on category [1]

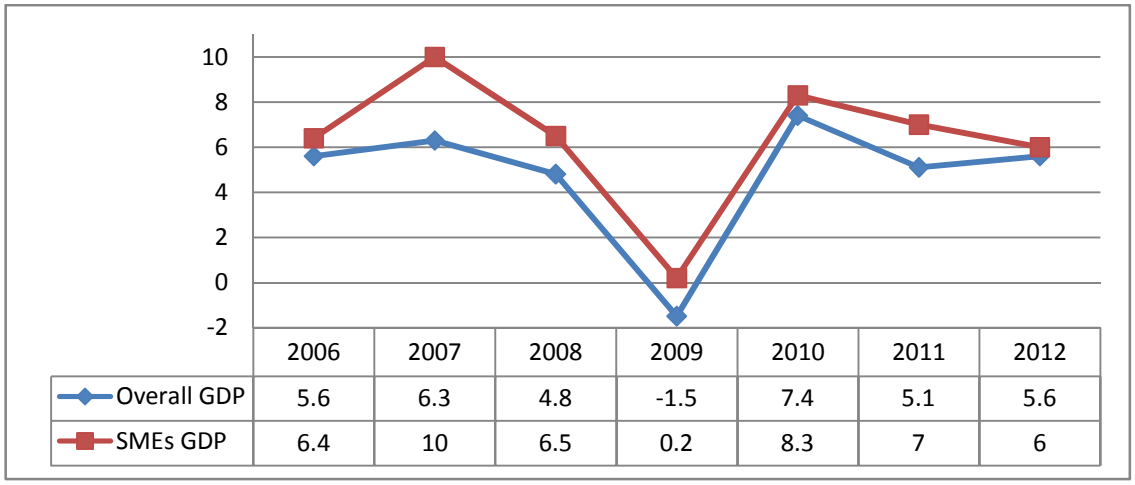
Category	Manufacturing	Service and other sectors
Micro	Sales turnover less than RM300,000 or less than 5 full time employees	Sales turnover less than RM300,000 or less than 5 full time employees
Small	Sales turnover between RM300,000 and RM15 million or between 5 and 75 full time employees	Sales turnover between RM300,000 and RM3 million or between 5 and 30 full time employees
Medium	Sales turnover between RM15 million and RM50 million or between 75 and 200 full time employees	Sales turnover between RM3 million and RM20 million or between 30 and 75 full time employees

1.2 Problem Statements

SMEs enterprises in Malaysia are classified into five main sectors including services, manufacturing, agriculture, construction, and mining & quarrying sectors. According to the Department of Statistics, Malaysia and SME Corporation Malaysia, the data in 2012 is rebased the SME GDP data on 2005 prices (refer Figure 1.1). For the period 2006 – 2012 the average annual growth rate of SMEs was 6.3%, higher than the average growth of the overall economy of 4.7% (refer Table 1.2) which prove that the SME contribution to Gross Domestic Product (GDP) increased from 29.4% in 2005 to 32.7% in 2012,with 3.3% increment (refer Table 1.3).

However, due to most of the researchers only focused on the company which generates higher profit annually, a few studies covered on the small industry in order to analyze their energy development, challenges and future prospects based on specific sector. On the other hand, particularly when dealing with very small organization, some of us might think that the organization only use a small amount of energy, assuming there is nothing to reduce and did not feel that those small industry had much potential to save.

Since there are unspecific research had been done to study the total energy demand and consume by this small industry, hence the project is done to identified the total energy consume and propose any possibility approach to reduce the energy use for small industry focusing on manufacturing sector under Food and Beverages Sector.



	2006	2007	2008	2009	2010	2011	2012
Overall GDP	5.6	6.3	4.8	-1.5	7.4	5.1	5.6
SMEs GDP	6.4	10	6.5	0.2	8.3	7	6

Figure 1.1: SME GDP Growth and Overall GDP (year-on-year growth %) [1]

Table 1.2: Yearly Overall GDP Growth and SME GDP Growth (2006 – 2012) in Constant 2005 Prices [1]

	2006	2007	2008	2009	2010	2011	2012	CACR 2006-2012
Overall GDP	5.6	6.3	4.8	-1.5	7.4	5.1	5.6	4.7
SMEs GDP	6.4	10.0	6.5	0.2	8.3	7.0	6.0	6.3

Table 1.3: SME GDP share by Key Economic Activity (constant 2005 prices) [1]

SME contribution to GDP	2005 (%share)	2012 (%share)	Increase/decrease in share	CACR 2006-2012
Services	17.0	20.2	+3.2	7.3
Manufacturing	8.1	7.9	-0.2	4.3
Agriculture	3.4	3.3	-0.1	4.1
Construction	0.7	0.9	+0.2	8.1
Mining & Quarrying	0.1	0.1	0	6.3
Overall	29.4	32.7	+3.3	6.3

1.3 Objectives

This project consists of a case study in order to identify the available method to improve the energy at small industry. There are three objectives of this project as follows:

i) To collect the energy usage data and understand the full process in small industry

ii) To analyze energy audit data and identified possible energy improvement plan

iii) To present cost benefit analysis on proposed alternative method for energy conservation management

1.4 Research Methodology

In order to achieve the objectives listed above, the premise information, data collection including the technical specification for all electrical appliances, the energy consumption pattern and production should be involved. The performances of the lighting installations were studied and a specific recommendation for lighting improvement has been suggested, whenever it was practically appropriate or not.

1.5 Scopes of Project

Since the focus of this study is to investigate the potential of energy improvement at small industry, thus the case study itself was not focusing on the highest utility bills, but considered any small industry that could made an improvement, either in term of process, operation and maintenance or safety aspect. Therefore Perusahaan Seri Mas, located at Ayer Hitam, Johor had been chosen as a case study. On the other hand, the energy sources were focus on electricity. Besides that, the simulation by using Proteus software and the prototype for quality improvement is developed.

1.6 Research Contribution

After this project is completed, it was expected that the method approach could make it easier for workers to improve the cooking process with time frame provided by the company systematically, avoid time lag during adding ingredients and maintained the dodol cooking quality standard. Thus could save at least 363.927kWh energy per year with total cost save about RM131.558 and payback time 3.20 years. Based on the analyze data, the projection for 32 small industries located at Batu Pahat is done with 11.646MWh and RM4, 209.856.the energy and the total cost could be save annual respectively.

1.7 Thesis Outline

This thesis is divided into four main sections:

i) **Literature Review.** The first section describes the electricity supply to Peninsular Malaysia, energy audit for lighting system, the current research study on energy at SMEs industry.

ii) **Research Methodology**. This section discussed in detail the research methodology applied in the project.

iii) **Energy Audit Result**. This section explains in details the project plan overview which managed in three phase; background of the premise, energy load pattern and process flow for cooking dodol and coconut candy

iv) **Data Analysis.** The forth sections analyze the energy usage pattern and approach alternative method for energy improvement. The propose method is briefly describe the improvement for lighting system and process improvement while cooking dodol. The cost calculation and payback time is provides in this section.

v) **Conclusion and Future Works.** The last section discussed the projection for small industries at Batu Pahat. For improvement, some ideas were suggest for future works.

REFERENCES

[1] National SME Development Council, "*SME Annual Report 2012/2013: Definition of SMEs*", 2013.

[2] Malaysia Energy Commision, *"Peninsular Malaysia Electricity Supply Industry Outlook 2013"*, 2013.

[3] Tenaga Nasional Berhad, *"SAVE Energy Programme: SAVE and Switch to Energy Efficient Appliances"*, 2012.

[4] Department of Forests, Ecology & Environment, Government of Karnataka, *"Domestic Energy Audit in urban dwellings*", Vol.1 No.5, December 2005.

[5] Wan Norsyafizan Wan Muhammad, Mohamad Yusof Mat Zain, Norfishah Wahab, Nor Hafizah Abdul Aziz, Rosmalini Abd Kadir, "*Energy efficient lighting system design for building*", International conference on intelligent systems, modeling and simulation, 2010.

[6] N.M.Maricar, M.H.Othman, "*Energy Audit Application for Building of Small and Medium Enterprise*", Saudi International on Electronics, Communications and Photonics Conference (SIECPC), Page 1- 4, 2013.

[7] Jorg Lassig, Wilhelm Riesner, "*Energy Efficiency Benchmark for Industrial SME*", International Conference on Smart Grid Technology, Economics and Policies (SG-TEP), Page 1 – 4, 2012.

[8] ZHANG Qi, CAI Jiu-ju, SONG Jun, LIU Wen-chao, "*Study on Energy Efficiency and Energy Management in Integrated Iron and Steel Works*", International Conference on Energy and Environment Technology, Page 341 – 343, 2009.

[9] C. Narasimha, N. Nagesha, "*Energy Efficiency in Sustainable Development of Small and Medium Enterprises: An Empirical Study*", 7th International Conference on Intelligent Systems and Control (ISCO), Page 487 – 491, 2013.

[10] Roaimah Omar, Rachel Samuel, "*Environmental Management amongst Manufacturing Firms in Malaysia*", 3rd International Symposium & Exhibition in Sustainable Energy & Environment (ISESEE), Page 148 -151, 2011.

[11] Philips Lighting, "*Energy Efficient lighting made easy. Simple solutions to help your factory save money"* Koninklijke Philips Electronics N.V 2010.

[12] Asian Electronics Limited, *"Advantages of using Electronic Ballasts"* [online] Available: www.aelgroup.com/**benefits**%20of%20**electronic**%20**ballasts**.pdf [Accessed: May 01, 2014].